EFFECT OF SUBSTITUTING MAIZE WITH SORGHUM, MILLET OR 'ACHA' ON THE GROWTH AND CARCASS CHARACTERISTICS OF BROILERS

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ABSTRACT

This study was carried out to evaluate the effects on the growth and carcass characteristics of broiler chickens of substituting low inputs grain,'acha', or medium inputs grains, sorghum and millet, for the high inputs grain, maize. Four isocaloric and isonitrogenous diets for both the starter and finisher phases were formulated with maize, sorghum, millet and 'acha' as the main source of energy as treatments 1, 2, 3 and 4, respectively. Marshall broiler birds were brooded up to 2 weeks before the treatments were introduced. From then up to 8 weeks of age, body weight, average daily gain, feed conversion ratio and mortality were recorded. The results of the study show no significant differences (P>0.05) between the four treatments in final body weight and average daily gain but birds ontreatment 4 ('acha') had significantly lower feed intake and superior feed conversion ratio than the other experimental diets. It was concluded that maize can be replaced with sorghum, millet and 'acha' without adverse effects on performance of broiler chickens.

Keywords: Broiler, millet, sorghum growth, carcass.

INTRODUCTION

Maize has high requirements for fertilizer and moisture when compared to sorghum, millet and acha.Maize, which supplies most of the energy in poultry feeds, has low yields in Nigeria and there is competition for the limited supply between industrial, livestock and human needs.The sudano-sahelian zone of West Africa is more conducive for sorghum, millet and acha production (Clement et al., 2010).Therefore, in order to sustain poultry production in the sudano-sahelian zone, there is need to replace maize (a high inputs grain) with sorghum and millet (medium inputs grains) or acha (low inputs grain) in poultry diets.

MATERIALS AND METHODS

The study was carried out at the Poultry Unit of the Teaching and Research Farm and the Poultry Meat Research Laboratory of the Department of Animal Sciences of Obafemi Awolowo University. The four grains were analysed for proximate fractions according to the methods of the Association of Analytical Chemist (AOAC, 1990) and tested for three mycotoxins (aflatoxin, fumonisin and ochratoxin).A total of 120, 2-weeks old Marshall broiler chicks were allotted into four treatments, each with three replicates of 10 birds per replicate in a randomized complete block design. Four isocaloric and isonitrogenous starter (2800 kcal, 23%CP) and finisher (2900 kcal, 20% CP) diets with maize, sorghum, millet and acha as the main source of energy were formulated for treatments 1, 2, 3 and 4, respectively. For six weeks, data were collected on feed intake, body weight, mortality and average daily gain and feed conversion ratio were calculated.Two digestibility trials were carried out at the 4th and 7th week of the experiment. All samples of feed and faeces were analysed for proximate components in triplicates.The experimental diets were analysed for two anti-nutritional factors: oxalate bythe titrimetric method and tannin bythe modified vanillin-hydrochloric acid method. At 8 weeks, three birds per treatment were randomly selected, slaughtered and dressed. Carcass proportions (thigh, breast, back, neck and wings) and organs (heart, liver, and gizzard) were determined. Immediately after slaughtering, the carcasses were chilled and stored in a chest freezer (-18^{0}C) for three days before carcass analysis. Frozen carcasses were thawed and the abdominal fat thickness and weight were measured according to the method of Sonaiya and Benyi (1983).All data collected were

subjected to analysis of variance and means were separated by Duncan's multiple range test.

RESULTS AND DISCUSSION

The results of the proximate, anti-nutritional and mycotoxin analysis of the experimental grainsobtained in this study (Table 1) are within the range reported previously (Clement *et al.*, 2010;Ballogou *et al.*, 2012and Bulus *et al.*, 2014).

The composition of experimental diets are on Tables 2 and 3.Table 4 shows the performance of broilers fed the experimental diets. Birds on the acha diet recorded the lowest feed intake and the best feed conversion ratio.This may be due to the high ME(3939kcal/kg)andhigh amino acid profile in acha as reported by Ballogou *et al* (2012). Birds on the sorghum diet recorded the poorest feed conversion ratio. Sorghum has the highest fibre and tannin content (Table 1) which agrees with the report of (Clement, 2010).Table 5 shows that there was no significant ($P>0.05$) difference in live and carcass weight among birds on the four treatments. Adamu *et al.* (2006) reported no depressive effect on growth when sorghum completely replaced maize in poultry diets. There was no significant difference among the treatments in all the carcass parameters except breast weight. Rama Rao *et al.* (2001) and Reddy *et al.* (2008) reported no significant difference in carcass characteristics when maize was replaced in poultry diets with sorghum at 100% or 50%, respectively. Bulus *et al.* (2014) reported a significant decrease in carcass measures when maize was totally replaced by millet in poultry diets. In this study, higher breast weight was observed in birds fed the acha diet as compared with those fed the maize diet. This agrees with the report of Ukim *et al.* (2012). Broilers with heavier breast weight are superior while higher abdominal fat weight indicates a poorer product.

CONCLUSION

The findings of this study showed that maize can successfully be replaced with sorghum, millet or acha without adverse effect on performance of broiler chickens.

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Table 1: Proximate, anti-nutritional* and mycotoxin component of the experimental grains

Parameters	Maize	Sorghum	Millet	Acha	SEM
Moisture	10±0.1	10±0.4	11±0.1	11±0.0	
Crude Protein	9±0.1	10±0.2	10±0.1	8±0.0	
Crude Fibre	2±0.2	5±0.2	4.5±0.1	2.1±0.3	
Ether Extracts	3±0.7	3±0.3	5±0.3	1.6±0.1	
Ash	2±0.3	3±0.1	3±0.1	2.7±0.0	
NFE	72±0.0	70±0.9	66±0.5	75±0.7	
Tannin (mg/g)	0.3^{b}±0.2	3.1^{a}±2.2	0.6^{b}±0.4	0.9^{b}±0.1	
Oxalate (mg/100g)	18^{a}±0.6	11^{c}±0.3	18^{a}±0.4	15.6^{b}±0.3	
Aflatoxin (µg/100g)	0.80^{a}	0.93^{a}	0.03^{b}	0.02^{b}	0.12
Ochratoxin (µg/100g)	0.01^{b}	1.50^{a}	0.04^{b}	0.01^{b}	0.05
Fuminosin (mg/kg)	0.01^{c}	7.83^{a}	0.01^{c}	3.00^{b}	0.14

[ab]Means in the same row having different superscripts differ significantly at P<0.05.
Proximate components have not been statistically compared.
*Figures for anti-nutritional factors are for experimental diets containing the grains

Table 2 Composition of starter diets.

	Experimental diets			
Ingredients	T1 (Maize)	T2 (Sorghum)	T3 (Millet)	T4 (Acha)
Test grain	50.00	52.00	53.00	45.00
Soybean meal	34.60	34.00	33.00	32.00
Wheat offal	6.00	5.00	5.00	5.00
Palm kernel cake	2.00	2.00	2.00	3.00
Fish meal	3.00	3.00	4.00	6.50
Bone meal	3.00	2.85	2.00	4.90
Limestone	0.50	0.50	0.40	3.00
Vit. premix	0.45	0.20	0.20	0.20
Common salt	0.25	0.20	0.20	0.20
Methionine	0.15	0.20	0.10	0.10
Lysine	0.05	0.05	0.10	0.10
Calculated values (%)	100	100	100	100
ME (kcal/kg)	2893	2856	2880	2884
Crude protein	23.07	23.37	23.25	23.11
Crude fibre	4.02	3.95	4.97	3.48
Ether extract	3.68	3.70	3.75	2.71
Calcium	1.55	1.49	1.21	3.34
Phosphorus	0.81	0.79	0.69	1.22
Lysine	1.55	1.32	1.47	1.43
Methionine	0.52	0.57	0.48	0.58

Table 3:Composition of finisher diets.

	Experimental diets			
Ingredients	T1 (Maize)	T2 (Sorghum)	T3 (Millet)	T4 (Acha)
Test grain	60.00	62.00	62.00	54.00
SB meal	25.00	25.00	25.40	22.40
Wheat offal	5.45	5.00	4.00	4.00
PK cake	2.00	2.00	2.00	4.00
Fish meal	3.40	3.00	3.25	7.00
Bone meal	3.00	2.00	2.00	3.00
Limestone	0.50	0.45	0.50	3.00
Vit premix	0.25	0.20	0.25	2.00
Common salt	0.25	0.20	0.20	0.20
Methionine	0.10	0.10	0.20	0.20
Lysine	0.05	0.05	0.20	0.20
Calc. values (%)	**100**	**100**	**100**	**100**
ME (kcal/kg)	2978	2943	2930	2977
Crude protein	20.23	20.69	20.24	20.17
Crude fibre	3.56	3.56	4.74	3.00
Ether extract	3.74	3.17	3.78	2.61
Calcium	1.56	1.16	1.18	2.65
Phosphorus	0.77	0.76	0.63	0.90
Lysine	1.11	1.15	1.34	1.29
Methionine	0.43	0.38	0.53	0.66

Premix provided to chicks with: vitamin A: 1000 IU; vitamin D_3: 500 IU; vitamin E: 5.75 IU; vitamin K_3: 0.5 mg; vitamin B_1: 0.45 mg; vitamin B_2: 1.25 mg; vitamin B_6: 0.75 mg; vitamin B_{12}: 0.00375 mg; Niacin: 6.875 mg; Pantothenic acid: 1.875 mg; Folic acid 0.1875 mg; Biotin H_2: 0.015 mg; C Choline chloride: 75 mg; Cobalt: 0.05 mg; Copper: 0.75 mg; Iodine: 0.25 mg; Iron: 5 mg; Manganese: 10 mg; Selenium: 0.05 mg; Zinc: 7.5 mg and Antioxidant: 0.3125mg.

Table 4: Performance of broilers fed experimental diets

Parameters	Experimental Diets				
	T1	T2	T3	T4	SEM
2 weeks body weight (g)	223	217	218	218	3.8
8 weeks body weight (g)	1481	1297	1428	1449	107
Ave daily weight gain (g)	30	26	29	29	2.6
Daily feed intake (g)	97^{a}	92^{a}	93^{a}	77^{b}	4.8
Feed conversion ratio	3.2^{ab}	3.6^{a}	3.3^{ab}	2.7^{b}	0.37
Mortality (%)	3^{b}	13^{ab}	20^{a}	13^{ab}	5.8

^{ab}Means in the same row having different superscripts differ significantly at $P<0.05$.

Table 5: Carcass characteristics of broilers fed experimental diets

Parameters	Experimental Diets				
	T1	T2	T3	T4	SEM
Live weight (g/bird)	1533	1323	1397	1456	107
Whole carcass weight (g/bird)	1291	1119	1165	1218	95
Fat thickness (mm)	4.3	2.3	3.7	2.3	1.04
Fat weight (g)	19.7	14.0	14.7	12.0	5.54
Thigh weight (g)	322	279	322	309	35
Breast weight (g)	247^{ab}	192^{b}	215^{ab}	251^{a}	26